

The Impact of Generative AI on Learning, Dependence, and Critical Thinking Among Management Students

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Abstract

This study examined the association of 'Generative AI usage' with 'effectiveness of learning', 'cognitive dependence', and 'confidence in critical thinking' among management students in India. The data were collected from 122 post-graduate management students (PGDM & MBA) with the help of a structured questionnaire on four constructs, i.e., 'Generative AI Usage (GAI)', 'Learning Effectiveness (LE)', 'Cognitive Dependence (CD)' and 'Critical Thinking Confidence (CT)'. The reliability analysis showed good internal consistency across all scales, with Cronbach's Alpha varying from 0.961 to 0.989. The correlation analysis results showed that the use of Generative AI was positively and significantly correlated with learning effectiveness ($r = 0.988$, $p < .001$) and cognitive dependence ($r = 0.947$, $p < .001$). However, it was negatively correlated with critical-thinking confidence ($r = -0.851$, $p < .001$). Regression analyses indicated that GAI_Total and Frequency_of_Use were significant predictors of all three outcome variables. Interestingly, cognitive dependence was most negatively associated with confidence in critical thinking ($r = -0.950$, $p < .001$). Comparisons based on the program revealed significant differences. PGDM students were more confident in their critical thinking abilities. MBA students reported more use of Generative AI, improved learning effectiveness, and greater cognitive dependence. No large gender differences were found for any construct. These findings highlight a paradox of Generative AI in management education: a paradox of higher perceived learning effectiveness with a concurrent cognitive dependence that may undermine confidence in critical thinking.

Keywords: Generative AI, Learning Effectiveness, Cognitive Dependence, Critical Thinking, Management Education

1. Introduction

Generative AI tools like ChatGPT, Claude, Gemini, etc. have changed the way students approach learning. Often, students use these tools for writing, brainstorming, and feedback (Dwivedi et al., 2023; Liu et al., 2025). This is particularly the case with B-Schools where AI can produce solutions to case studies and business plans in no time (Valcea et al., 2024).

It is usually a Catch-22 situation with Generative AI deployment in education. Generative AI tools can provide personalized learning at levels that were previously thought impossible. Research has shown that using such tools can improve critical thinking and problem-solving skills (Daniel et al., 2025). On the flip side, it is possible that students could become over-dependent on such AI tools. This is known as “cognitive offloading,” where students transfer the heavy-lifting 'thinking' work to the tool, which tends to reduce their own problem-solving skills (Zhang & Xu, 2024). Some studies have found that students who use AI most often perform worse on tests of critical thinking (Tian & Zhang, 2025).

Four hypotheses were developed for this study:

- **H1:** Generative AI Usage is positively related to perceived learning effectiveness.
- **H2:** Generative AI Usage is positively related to cognitive dependence.
- **H3:** Generative AI Usage is negatively related to critical thinking confidence.
- **H4:** Frequency of Generative AI usage significantly predicts all three outcome variables- learning effectiveness, cognitive dependence, and critical thinking confidence.

This research aims to test these four hypotheses among post-graduate management students.

2. Literature Review

2.1 Generative AI in Higher Education

Generative AI has emerged as a powerful tool in the learning arsenal. LLMs (Large language models) can collate information and provide multi-dimensional insights (Dwivedi et al., 2023). AI is mainly used for case analysis and strategic planning in management education. Valcea et al. (2024) found that while Generative AI can help students understand topics, its ease of use and availability can also pose a risk. If used recklessly, it might hinder students from developing

their higher-level thinking skills. The effect of AI depends on how teachers design their courses and how much AI literacy students have (Liu et al., 2025).

2.2 Learning Effectiveness and Generative AI

Many studies have considered Generative AI in learning. A review found that 94% of studies reported improvements in cognitive skills (Daniel et al., 2025). AI can offer personalized learning and feedback (Chen & Cheung, 2025). For management students, AI has been shown to help with understanding topics, but there is a risk of "deskilling" if students rely on it too much (Valcea et al., 2024).

2.3 Cognitive Dependence and AI Overreliance

There is growing evidence that relying on AI can lead to cognitive dependence. This is "cognitive offloading" (Risko & Gilbert, 2016), where students use AI to avoid mental effort. This can lead to less creative thinking and a greater acceptance of whatever the AI generates without question (Zhang & Xu, 2024). Students who see AI as highly reliable may stop checking its work, leading to shallower thinking (Hou et al., 2025).

2.4 Critical Thinking and AI-Mediated Cognition

Critical thinking is a key skill for students. It involves analyzing and evaluating information (Ennis, 2018). The use of AI raises questions about whether it helps or hurts the development of this skill. Some studies show AI can help with reasoning, while others highlight problems like decreased creativity and analytical depth (Crudele & Raffaghelli, 2025; Zhang & Xu, 2024). The concern is that AI use creates an "illusion of competence"—students feel capable because they can produce 'good-quality' work, for which they haven't actually developed the skills to evaluate it.

2.5 Demographic Factors in AI Usage

Research on gender differences in AI use is mixed. Some studies show men are more positive about AI, but other studies find no gender difference (Krammer, 2025). Differences between MBA and PGDM students are less explored.

3. Methodology

3.1 Research Design and Sample

A cross-sectional survey design was used for the study. Data were collected from 122 post-graduate management students (both PGDM & MBA in equal measure) in India. The sample was 50.8% male and 48.4% female. The average age was 24 years. Students were chosen using convenience sampling.

3.2 Measures

The questionnaire had five sections using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree):

- **Generative AI Usage (GAI):** 5 items about how often and how students use AI for academic work.
- **Learning Effectiveness (LE):** 5 items about how helpful students think AI is for their learning.
- **Cognitive Dependence (CD):** 5 items about students' dependence on AI for tasks.
- **Critical Thinking Confidence (CT):** 5 items about students' confidence in their own critical thinking skills without AI.
- **Demographics:** Age, gender, program, and frequency of Generative AI use.

3.3 Ethical Considerations

All participants were informed about the study's purpose and that their responses were anonymous and confidential. Participation was voluntary.

3.4 Data Analysis

The data were analyzed using JMP software. We used descriptive statistics, Cronbach's alpha for reliability, and Pearson correlation for checking relationships. T-tests and ANOVAs were used for group comparisons. We used multiple regression to test our hypotheses.

We tested for common method bias using Harman's single-factor test. The single factor explained only 42.6% of the variance, which is below the 50% threshold, suggesting bias is not a major concern.

High correlations between constructs suggested potential multicollinearity. The high correlations (e.g., $r > 0.90$) reflect the interconnectedness of the constructs in theory, but they were also kept in mind when interpreting the results.

4. Results

4.1 Descriptive Statistics

Table 1: Demographic Characteristics

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	62	50.8
	Female	59	48.4
	Missing	1	0.8
Programme	MBA	61	50.0
	PGDM	61	50.0
Frequency of Use	Very Frequently	31	25.4
	Frequently	45	36.9
	Rarely	29	23.8
	Never	17	13.9
Age	Mean (SD)	24.10 (2.96)	Range: 22-27

The average scores were: GAI = 3.57, LE = 3.76, CD = 2.82, and CT = 3.84.

4.2 Reliability Analysis

Cronbach's alpha was very high for all scales, showing excellent internal consistency (GAI $\alpha=0.971$, LE $\alpha=0.989$, CD $\alpha=0.981$, CT $\alpha=0.961$). This high reliability could indicate item redundancy.

4.3 Correlation Analysis

Table 2: Correlation Matrix

Variable	GAI_Total	LE_Total	CD_Total	CT_Total
GAI_Total	1.000	0.988**	0.947**	-0.851**
LE_Total	0.988**	1.000	0.943**	-0.847**
CD_Total	0.947**	0.943**	1.000	-0.950**
CT_Total	-0.851**	-0.847**	-0.950**	1.000
**p < .001				

Generative AI use was strongly positively associated with self-reported learning ($r = 0.988$) and tool dependence ($r = 0.947$), but negatively associated with critical-thinking confidence ($r = -0.851$). The most powerful correlation was between dependence and diminished critical-thinking confidence ($r = -0.950$), indicating that reliance on AI may undermine confidence in critical reasoning ability.

4.4 Group Comparisons

There were **no significant gender differences** for any of the four constructs.

There were **significant differences between MBA and PGDM students**. MBA students reported higher Generative AI usage, higher learning effectiveness, and higher cognitive dependence. PGDM students reported higher critical thinking confidence.

Table 3: Programme Comparisons

Variable	Direction	t Ratio	p-value
GAI_Total	MBA > PGDM	-2.144	0.034*

Variable	Direction	t Ratio	p-value
LE_Total	MBA > PGDM	-2.314	0.022*
CD_Total	MBA > PGDM	-2.209	0.029*
CT_Total	PGDM > MBA	2.165	0.032*
*p < .05			

ANOVA showed significant differences by frequency of use for all constructs. More frequent users had higher GAI, LE, and CD, but lower CT.

4.5 Regression Analysis

We ran three regression models.

Table 4: Regression Results

Predictor	Model 1 (LE_Total)	Model 2 (CD_Total)	Model 3 (CT_Total)
GAI_Total (β)	0.246***	0.573***	-0.516***
Gender (Female)	0.016	-0.029	0.009
Programme (MBA)	0.010	0.004	-0.008

Predictor	Model 1 (LE_Total)	Model 2 (CD_Total)	Model 3 (CT_Total)
F-Value (Freq_of_Use)	44.39*	37.45*	44.04*
R²	0.990	0.948	0.872
F Ratio (Model)	1848.55*	348.01*	130.66*

** $p < .001$; $p < .05$ (for Frequency_of_Use row)

- **Model 1 (Learning):** GAI_Total and Frequency_of_Use were significant positive predictors.
- **Model 2 (Dependence):** GAI_Total and Frequency_of_Use were significant positive predictors.
- **Model 3 (Critical Thinking):** GAI_Total and Frequency_of_Use were significant negative predictors.

Gender and Programme were not significant predictors in any of the models.

4.6 Validated Research Model

Based on the empirical findings, the validated research model is presented in Figure 1. The model illustrates the significant pathways identified through correlation and regression analyses.

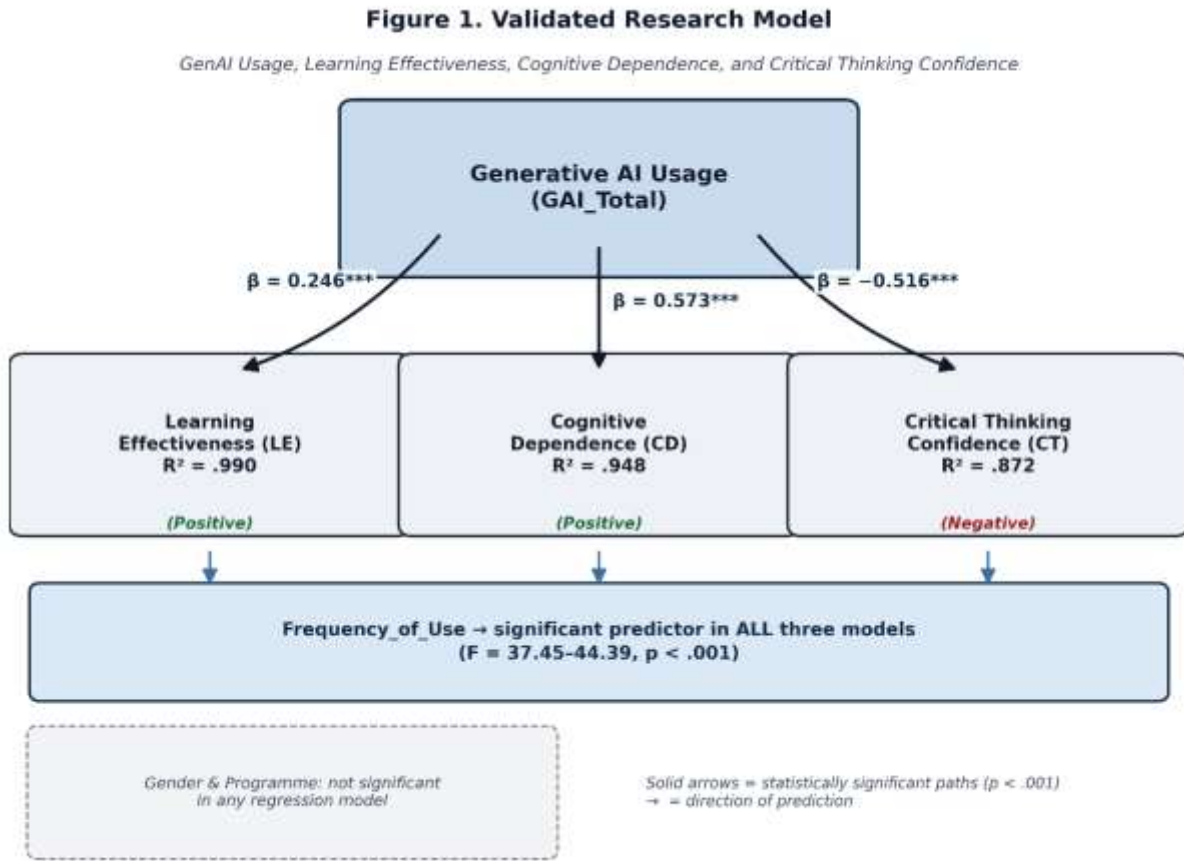


Figure 1: Validated Research Model

Note: *** $p < .001$

Solid lines indicate significant paths.

Frequency_of_Use was a significant predictor in all three models ($p < .001$).

Figure 1 Notes:

- **Solid lines** represent statistically significant relationships ($p < .001$)
- **GAI_Total** positively predicts LE_Total ($\beta = 0.246$) and CD_Total ($\beta = 0.573$)
- **GAI_Total** negatively predicts CT_Total ($\beta = -0.516$)
- **Frequency_of_Use** was a significant predictor in all three models
- **Gender** and **Programme** were not significant predictors in the regression models.



- The model explains 99.0% of variance in LE_Total, 94.8% in CD_Total, and 87.2% in CT_Total

5. Discussion

Our study shows that Generative AI use has a complex effect on students. The results support all four of our hypotheses.

- **H1 (Learning):** We found a strong positive link. Students who use Generative AI more report they learn more effectively. This matches other research showing AI can improve cognitive skills (Daniel et al., 2025).
- **H2 (Dependence):** We found a strong positive link. More Generative AI use is linked to higher cognitive dependence. This supports the idea of "cognitive offloading," where students allow AI to think on their behalf (Risko & Gilbert, 2016).
- **H3 (Critical Thinking):** We found a strong negative link. More Generative AI use is linked to lower confidence in critical thinking. This is a major concern and aligns with the idea that AI dependence can lead to "metacognitive laziness" (Tian & Zhang, 2025).
- **H4 (Frequency):** The frequency of Generative AI usage was a significant predictor for all three outcome variables.

The strongest link we found was between cognitive dependence and low critical thinking confidence. This suggests that the main problem with AI use is not the tool itself, but the dependence it can create. Students who rely heavily on AI may lose confidence in their own abilities.

5.1 Programme Differences

The differences between MBA and PGDM students are interesting. MBA students used AI more and reported higher dependence. PGDM students had higher critical thinking confidence. This suggests that differences in course design or teaching methods might affect how students use and are influenced by AI.

5.2 Implications for Management Education

Our findings have clear implications for management educators. While Generative AI can help students learn, it must be used carefully to avoid creating dependence. We recommend:



1. **Teach AI Literacy:** Students need to learn how to use AI critically, not just as a shortcut.
2. **Redesign Assessments:** Tests should measure reasoning and process, not just final output.
3. **Balance AI Use:** Give students tasks both with and without AI to build their confidence.
4. **Clear Guidelines:** Set sensible rules for AI use that encourage learning, not just efficiency.

The goal should be to help students develop "AI judgment"—the ability to know when and how to use AI to support, not replace, their own thinking.

5.3 Limitations

This study has several limitations:

- **Cross-Sectional Design:** We can only show relationships, not cause and effect. We need future research that follows students over time.
- **Self-Report Measures:** Students were reporting on their own behavior, which can be biased.
- **Single Context:** The data came from one business school in India, so the results might not apply to other places.
- **Construct Overlap:** The very high correlations between constructs might mean we were measuring overlapping concepts. This could mean our scales were not capturing distinct ideas, which is a threat to "discriminant validity." High Cronbach's alpha values also hint at item redundancy. This is something for future research to examine with more advanced statistical methods.
- **Multicollinearity:** The high correlations between predictor variables might have affected our regression results.

6. Conclusion

This study examined how Generative AI affects learning, dependence, and critical thinking confidence among management students. We found a "double-edged" effect. Generative AI is strongly linked to perceived learning improvements, but it is also strongly linked to cognitive dependence and lower confidence in critical thinking.

All four of our hypotheses were supported. Our results suggest that the benefits of Generative AI use may come with a cognitive cost. Management educators need to use strategies that

harness the positive benefits of AI while protecting students' intellectual independence. This involves teaching AI literacy and designing assessments that value critical thinking.

References

- Chen, S., & Cheung, A. C. K. (2025). Effect of generative artificial intelligence on university students' learning outcomes: A systematic review and meta-analysis. *Educational Research Review*, 49, 100737. <https://doi.org/10.1016/j.edurev.2025.100737>
- Crudele, F., & Raffaghelli, J. E. (2025). Gotcha! Enhancing argumentation as a basis for critical thinking via generative AI-supported learning in higher education. *Journal of E-Learning & Knowledge Society*, 21(3), 20. <https://doi.org/10.20368/1971-8829/1136130>
- Daniel, K., Msambwa, M. M., & Wen, Z. (2025). Can generative AI revolutionise academic skills development in higher education? A systematic literature review. *European Journal of Education*, 60, e70036. <https://doi.org/10.1111/ejed.70036>
- Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., Baabdullah, A. M., Koohang, A., Raghavan, V., Ahuja, M., Albanna, H., Albashrawi, M. A., Al-Busaidi, A. S., Balakrishnan, J., Barlette, Y., Basu, S., Bose, I., Brooks, L., Buhalis, D., ... Williams, M. D. (2023). "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *International Journal of Information Management*, 71, 102642. <https://doi.org/10.1016/j.ijinfomgt.2023.102642>
- Ennis, R. H. (2018). Critical thinking across the curriculum: A vision. *Topoi*, 37(1), 165–184. <https://doi.org/10.1007/s11245-016-9401-4>
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate data analysis* (7th ed.). Pearson Education.
- Hou, C., Zhu, G., & Sudarshan, V. K. (2025). The role of critical thinking on undergraduates' reliance behaviours on generative AI in problem-solving. *British Journal of Educational Technology*, 56(5), 1919–1941. <https://doi.org/10.1111/bjet.13613>
- Hyde, S., Busby, A., & Bonner, R. (2024). Tools or fools: Are we educating managers or creating tool-dependent robots? *Journal of Management Education*, 48(4), 708–734. <https://doi.org/10.1177/10525629241230357>

Jose, E. M. K., Prasanna, A., Kushwaha, B. P., & Das, M. (2024). Can generative AI motivate management students? The role of perceived value and information literacy. *The International Journal of Management Education*, 22(3), 101082. <https://doi.org/10.1016/j.ijme.2024.101082>

Krammer, S. M. S. (2025). Is there a glitch in the matrix? Artificial intelligence and management education. *Management Learning*, 56(2), 367–388. <https://doi.org/10.1177/13505076231217667>

Liu, Q., Hu, A., Gladman, T., & Gallagher, S. (2025). Eight months into reality: A scoping review of the application of ChatGPT in higher education teaching and learning. *Innovative Higher Education*, 50(5), 1677–1700. <https://doi.org/10.1007/s10755-025-09790-4>

Lo, C. K., Hew, K. F., & Jong, M. S.-y. (2024). The influence of ChatGPT on student engagement: A systematic review and future research agenda. *Computers & Education*, 219, 105100. <https://doi.org/10.1016/j.compedu.2024.105100>

Perera, P., Kulathunga, V. K., Perera, N. N., Gunarathna, A., Jayasinghe, P. S. K., & Rajamanthri, L. (2025). Adoption of ChatGPT in higher education: A systematic literature review of lecturers' perspective based on UTAUT2. *Asian Education and Development Studies*, 15(1), 89–113. <https://doi.org/10.1108/AEDS-11-2024-0275>

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879–903. <https://doi.org/10.1037/0021-9010.88.5.879>

Risko, E. F., & Gilbert, S. J. (2016). Cognitive offloading. *Trends in Cognitive Sciences*, 20(9), 676–688. <https://doi.org/10.1016/j.tics.2016.07.002>

Rocha Yucra, R. B., & Rocha Mareño, P. N. (2026). Pensamiento crítico e IA generativa en universitarios: Dependencia cognitiva, factores moderadores y la paradoja educativa. *Revista Ciencia, Tecnología y Sociedad*, 4(1), 40–50. <https://doi.org/10.70598/oksr1313oo29m>

Sun, L., & Zhou, L. (2024). Does generative artificial intelligence improve the academic achievement of college students? A meta-analysis. *Journal of Educational Computing Research*, 62(7), 1896–1933. <https://doi.org/10.1177/07356331241277937>

Tian, J., & Zhang, R. (2025). Learners' AI dependence and critical thinking: The psychological mechanism of fatigue and the social buffering role of AI literacy. *Acta Psychologica*, 260, 105725. <https://doi.org/10.1016/j.actpsy.2025.105725>

Valcea, S., Hamdani, M. R., & Wang, S. (2024). Exploring the impact of ChatGPT on business school education: Prospects, boundaries, and paradoxes. *Journal of Management Education*, 48(5), 915–947. <https://doi.org/10.1177/10525629241261313>

Woodside, S. J. (2025). And the 2024 Roethlisberger Award goes to . . . "Exploring the Impact of ChatGPT on Business School Education". *Journal of Management Education*, 49(6), 789–805. <https://doi.org/10.1177/10525629251375989>

Zhang, L., & Xu, J. (2024). The paradox of self-efficacy and technological dependence: Unraveling generative AI's impact on university students' task completion. *Internet and Higher Education*, 63, 100978. <https://doi.org/10.1016/j.iheduc.2024.100978>